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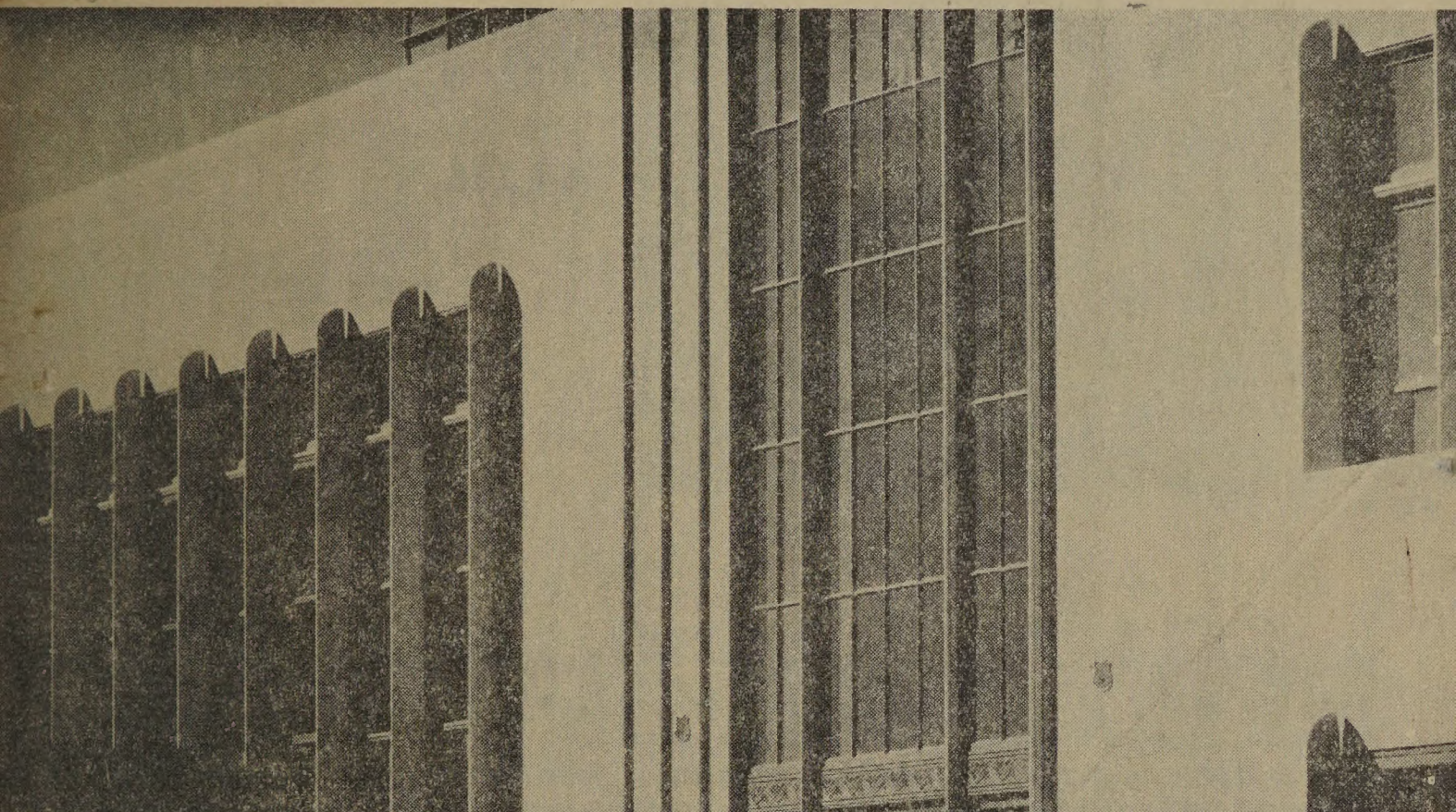
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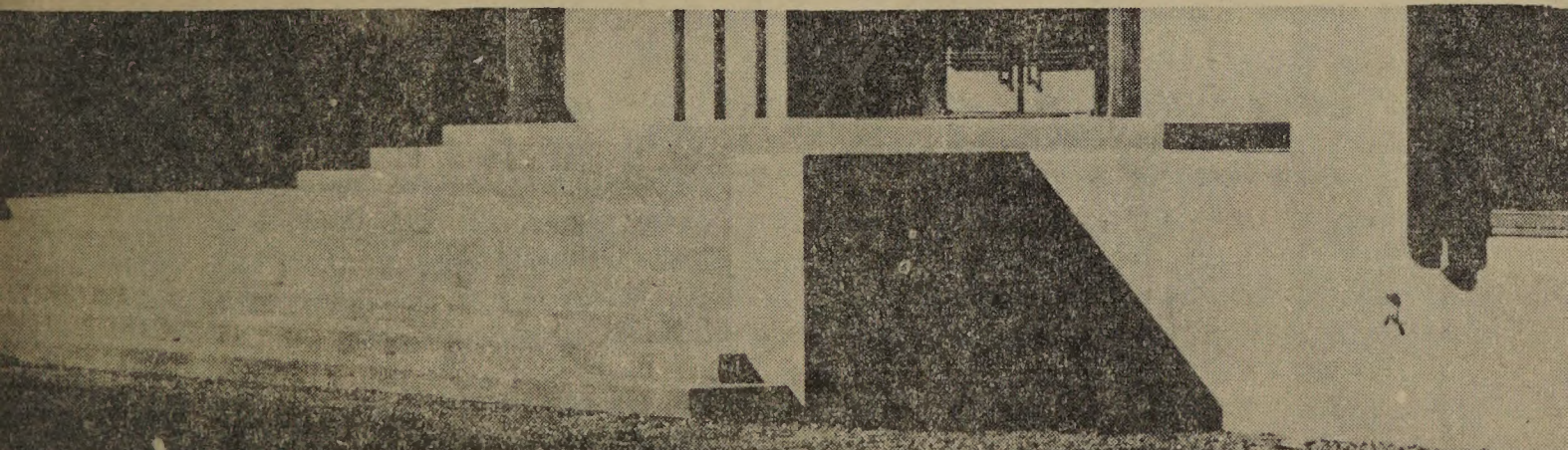
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1949

FOREST PRODUCTS LABORATORY

*Madison,
Wisconsin.*



U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE.



*Maintained In Cooperation With
The University of Wisconsin*

1949



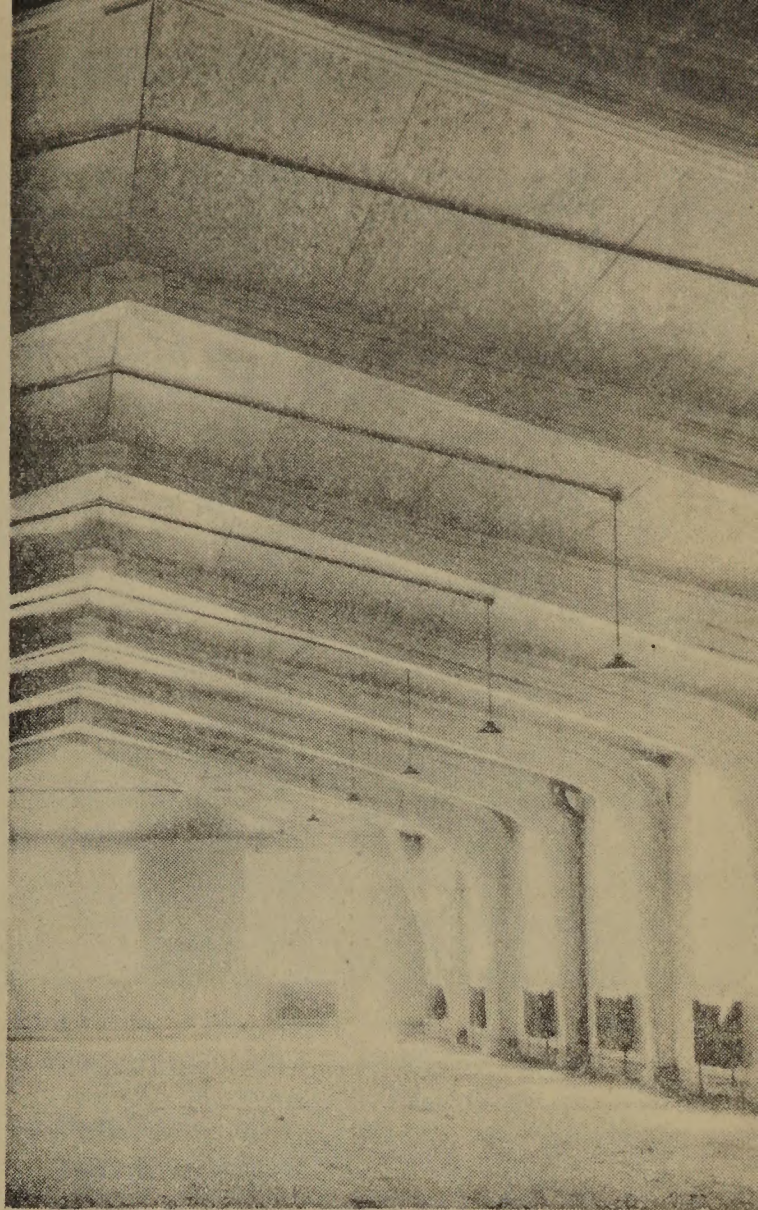
**PROPER
FOREST UTILIZATION
BUILDS
A SECURE
AND PROSPEROUS
NATION**

A nation cannot long remain secure and prosperous without an adequate supply of forest products. The success with which its 600 million acres of forest land fulfill America's needs in this regard depends upon efficient forest management and the maximum utilization of the forest products. Aside from their other uses, such as protection of watersheds, these forest lands must pay their way in the national economy by furnishing a vital raw material — one that sustains a major field of industrial activity in harvesting, processing and remanufacture of forest products. Both private and public forests, from the small woodlots of individual farmers to the vast national forests, bring the most in national security and prosperity only if they are kept in good producing condition.

In order to achieve its greatest success, forest management depends upon maximum utilization of forest products. The accomplishment of this end can be attained only by diligent use of existing knowledge of forestry and by persistent efforts to develop new and improved uses for forest products. By these means, the value of the Nation's resources will be increased, the economy of communities dependent upon forest products for employment will be made more stable, and the standard of living of their residents will be improved.

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**IMPROVED
SERVICEABILITY OF
FOREST PRODUCTS
IS AIM OF
U. S. FOREST PRODUCTS
LABORATORY**



GLUED-LAMINATED ARCH BUILDING

The Forest Products Laboratory is a scientific research institution whose purpose is to obtain information that will aid in increasing the value and usefulness of the products of the Nation's forests. It was established in 1910 as a part of the Forest Service of the U. S. Department of Agriculture and since then has worked consistently to aid in the solution of problems involving both the determination of fundamental principles and their application that have faced the users of forest products. Assistance has been given not only to the large companies in the wood industries and to other Governmental agencies, but also to thousands of individuals who have written or come to the Laboratory seeking information about their own wood-use problems.

The work of the Laboratory is directed toward increasing knowledge about wood and wood products so that the timber crops may be converted into useful products more efficiently and therefore more economically; that these products may give better and longer service; that new or improved uses may be found for the Nation's timber crop, including those species now little used; and that the wood requirements of the American people may be ever more satisfactorily met.

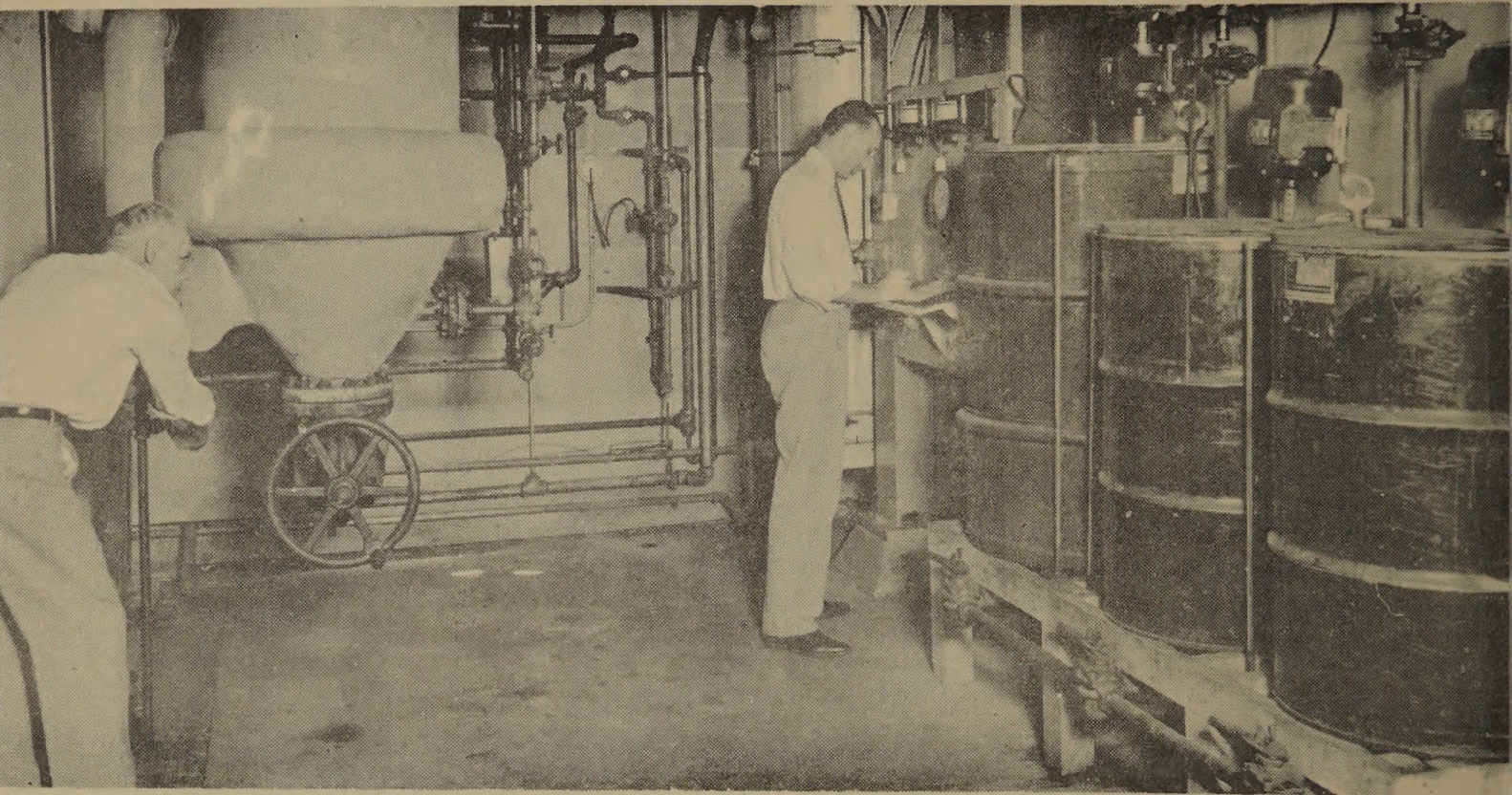
The Laboratory's research benefits the producers of forest crops, the processors and handlers of forest products, and the consumers of these products. Because there is no person who does not belong to one or more of these groups, the work of the Laboratory, which is done for the people, is of real concern to all. The work of the Laboratory, therefore, is directed to the solution of national, regional, and local forest products problems.

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WOOD IS A STOREHOUSE OF RAW MATERIALS

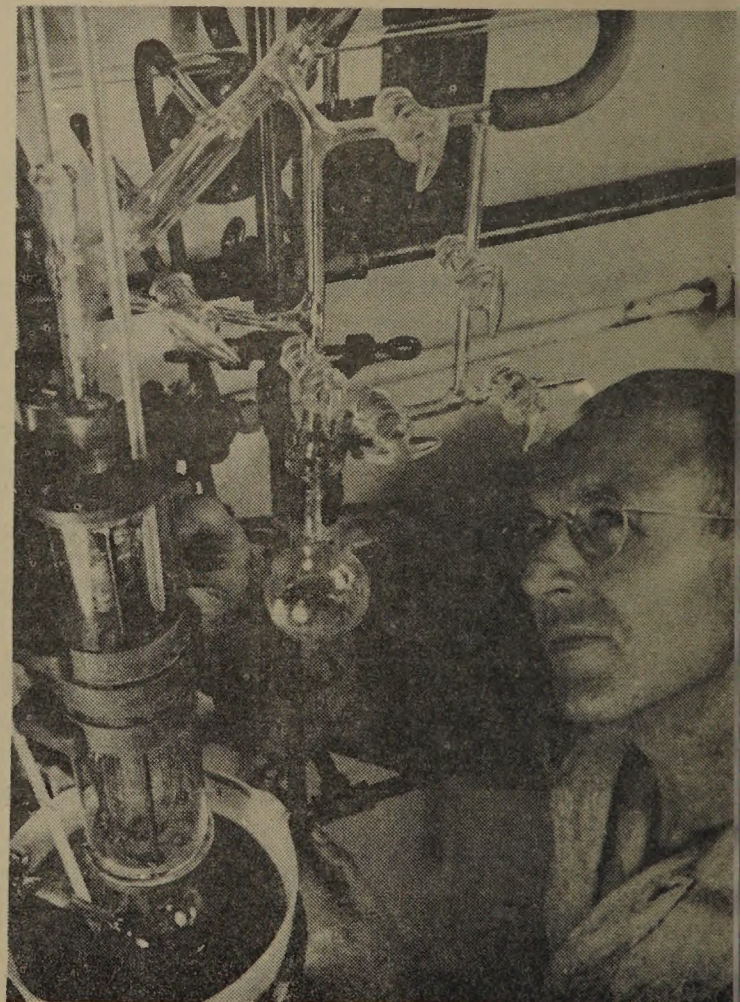


PART OF FOREST PRODUCTS LABORATORY
PILOT PLANT FOR CONVERTING SAWMILL
WASTE TO WOOD SUGARS

Many products, once unknown, today are manufactured from wood through the application of chemistry. Rayons, cellophane, lacquers, photographic film, gunpowder, and nitrate and acetate plastics are some of the many products now made from cellulose, the chief component of wood. Laboratory chemists have found methods to convert cellulose into sugars that may be concentrated into molasses for feeding animals, fermented to produce grain alcohol and valuable chemicals, or used for the growth of yeast.

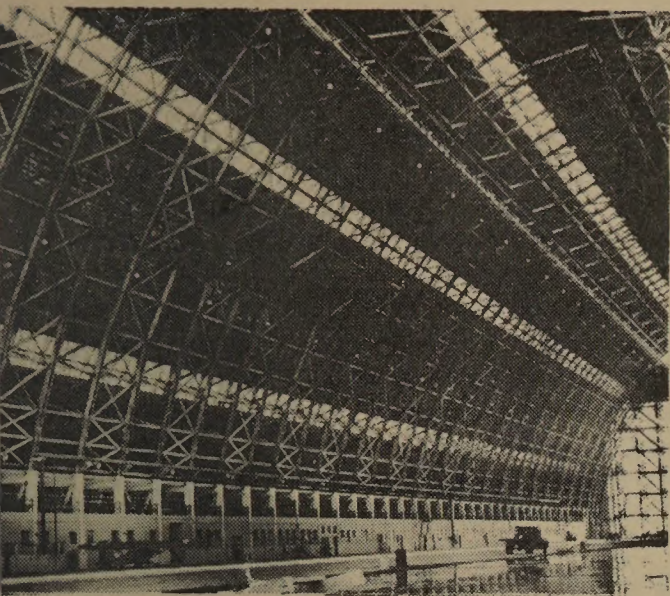
Research in wood chemistry is resulting in practical uses for lignin, the other major wood substance, which was once discarded as completely valueless waste. Vanillin and tanning substitutes can now be made from lignin, and it is used in the plates of storage batteries. Recent tests indicate that it may be used in plastics. It also appears to contain valuable complex alcohols, phenols, and neutral oils.

The tendency of raw wood to shrink and swell can now be drastically reduced by treatments developed at the Laboratory.. The continuing efforts of the chemists increase the value of America's forests by developing new products, improving old ones, and reducing wood waste.

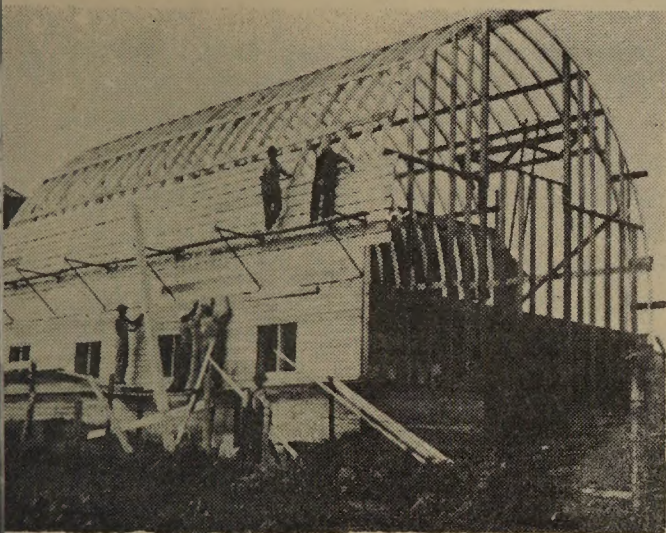


DISTILLING PRODUCTS OF LIGNIN

STRENGTH OF WOOD IS DETERMINED FOR ALL TYPES OF SERVICE

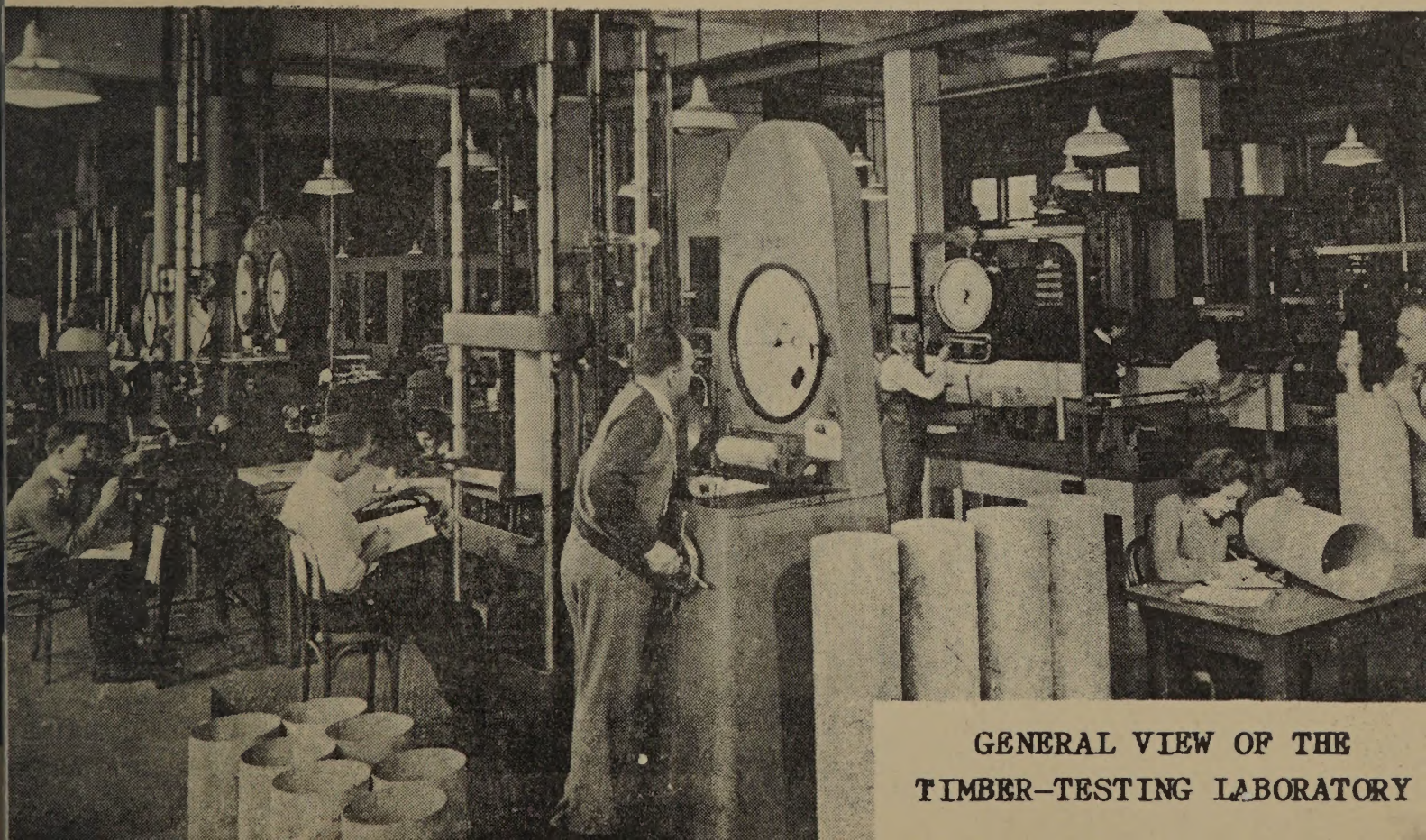


HANGAR WITH TIMBER ARCHES



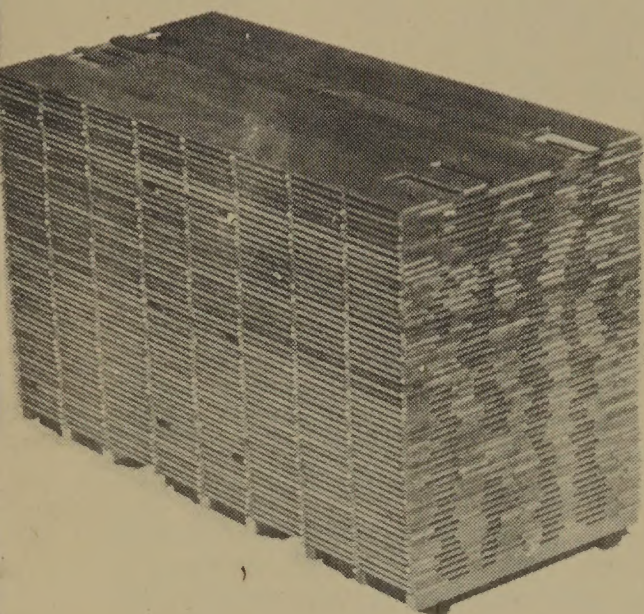
MODERN BARN CONSTRUCTION WITH
LAMINATED ARCHES

More than 1,200,000 tests have been made at the Laboratory to evaluate the mechanical properties of wood and materials derived from wood. They range from basic strength tests made on simple specimens 2 by 2 inches in size to tests of complex structures, such as full-sized housing panels. Some tests are completed in a few minutes; others simulating a different type of service cover a period of years. Some involve only one stroke of a machine; in others the specimen is subjected to as many as 30,000,000 repetitions of load before failure. Tests are made under normal conditions of temperature and humidity as well as under conditions that simulate the extremes of desert heat or arctic cold. These strength tests provide the basic information required to adapt the materials ever more satisfactorily to their various uses, including housing, aircraft, timber structures, boats, and industrial equipment.

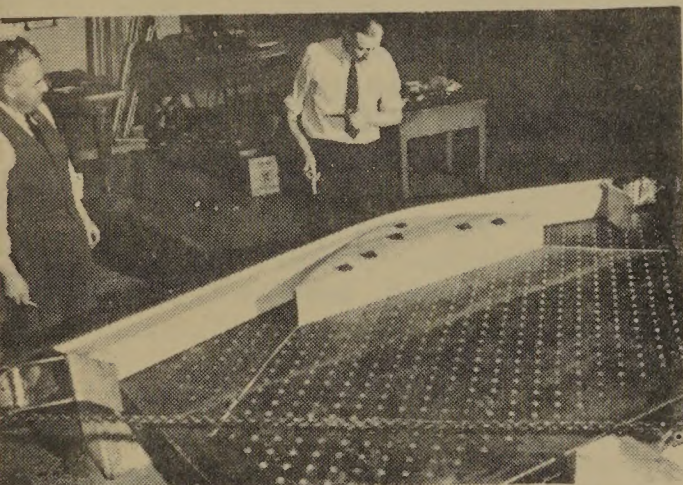


GENERAL VIEW OF THE
TIMBER-TESTING LABORATORY

IMPROVED SEASONING METHODS MEAN MORE SATISFACTION FROM THE USE OF WOOD



EFFECTIVE METHODS OF
PILING LUMBER FOR SEASONING
ARE DETERMINED

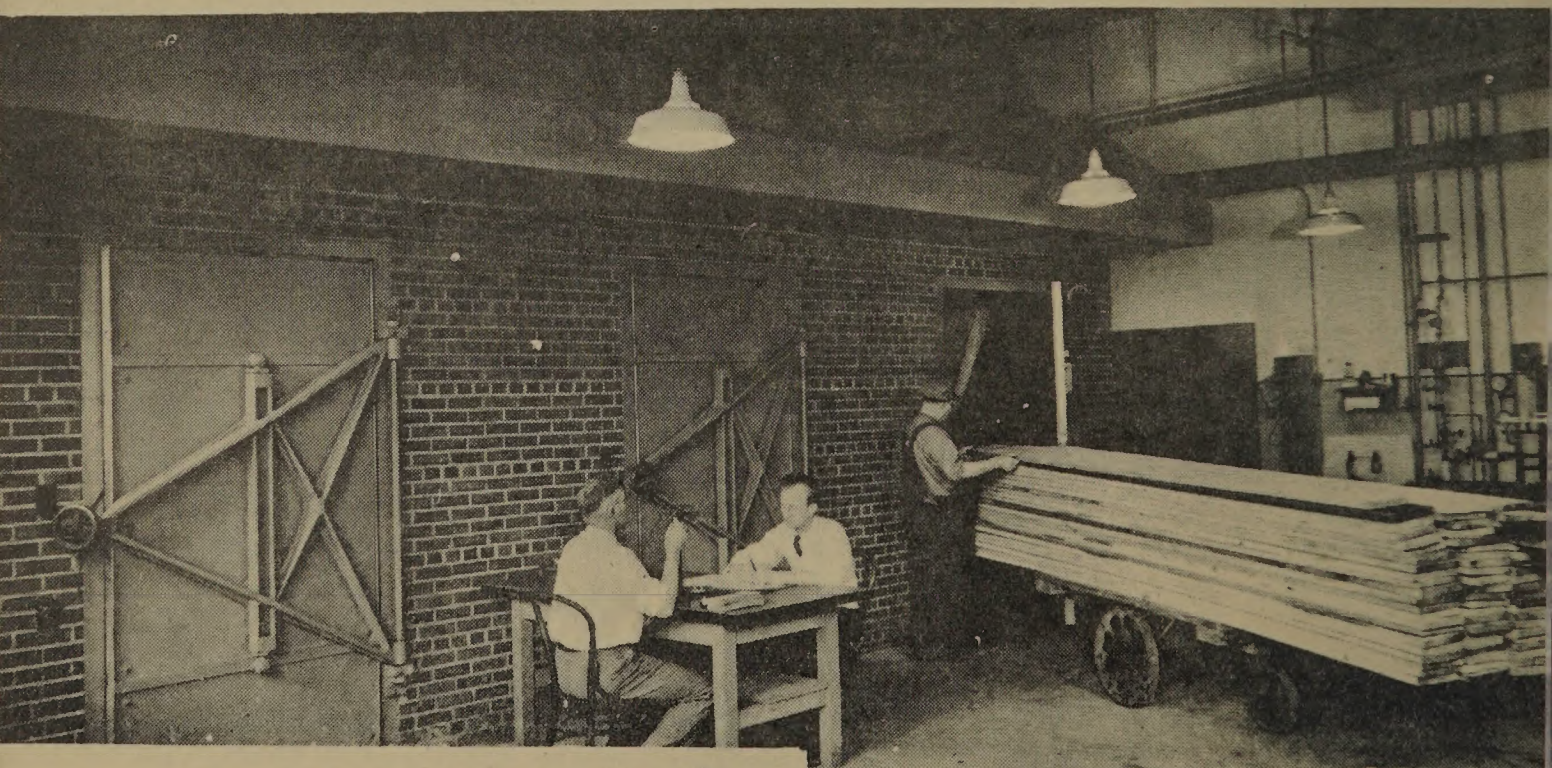


STUDIES OF BENDING QUALITIES OF
OAK REDUCE LOSSES IN INDUSTRY

When wood dries it shrinks. Uncontrolled shrinkage frequently results in uneconomical utilization of our forest resources.

From the time when it pioneered in the science of kiln drying lumber, the Laboratory has led the nation in the improvement of techniques for seasoning wood to reduce drying losses to a minimum. The work has included air drying, kiln drying, and special drying methods for accelerating the drying of wood or controlling degrade. These include high-frequency dielectric heating and chemical seasoning.

Thousands of commercial dry kilns built upon the principles established by the Laboratory are in operation throughout the country. Kilns are now used to season a number of species that were once considered incapable of being kiln dried. Improvements in the methods of seasoning have made possible the use of alternate species to bolster the dwindling supply of traditional favorites.

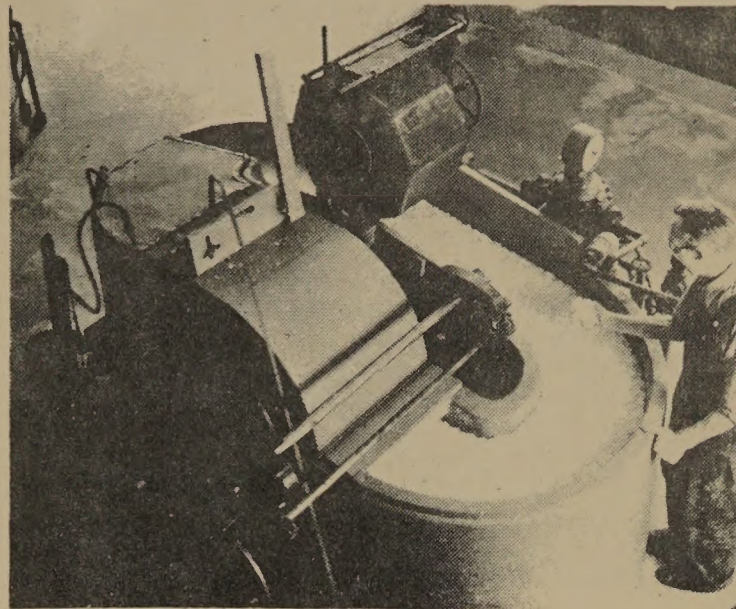


THREE OF THE LABORATORY'S DRY KILNS
FOR EXPERIMENTS IN SEASONING

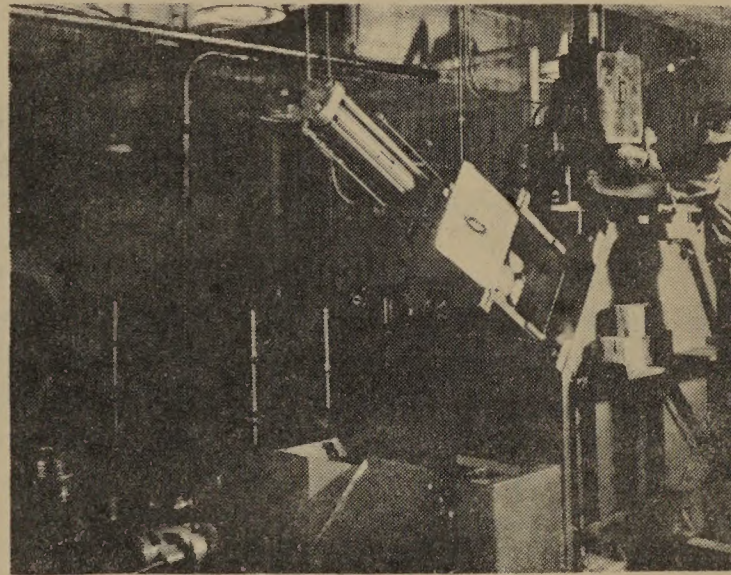
GREATER USE OF NATIVE WOODS, AIM OF PULP AND PAPER RESEARCH

Although more than 18 million cords of domestic pulpwood are consumed annually in the manufacture of approximately 21 million tons of paper and paperboard in the United States, additional large quantities of pulpwood, pulp, and paper must be imported to meet the demand for these products. At the same time, it is well known that large supplies of little-used species exist in the forests of America, as well as great amounts of unused residues from logging and lumber manufacture. This situation has led the Laboratory, therefore, to work to increase the possibilities of more economical production, higher yield, and better pulp quality from native woods, including low-grade wood, wood residues, and those species now little used or unused.

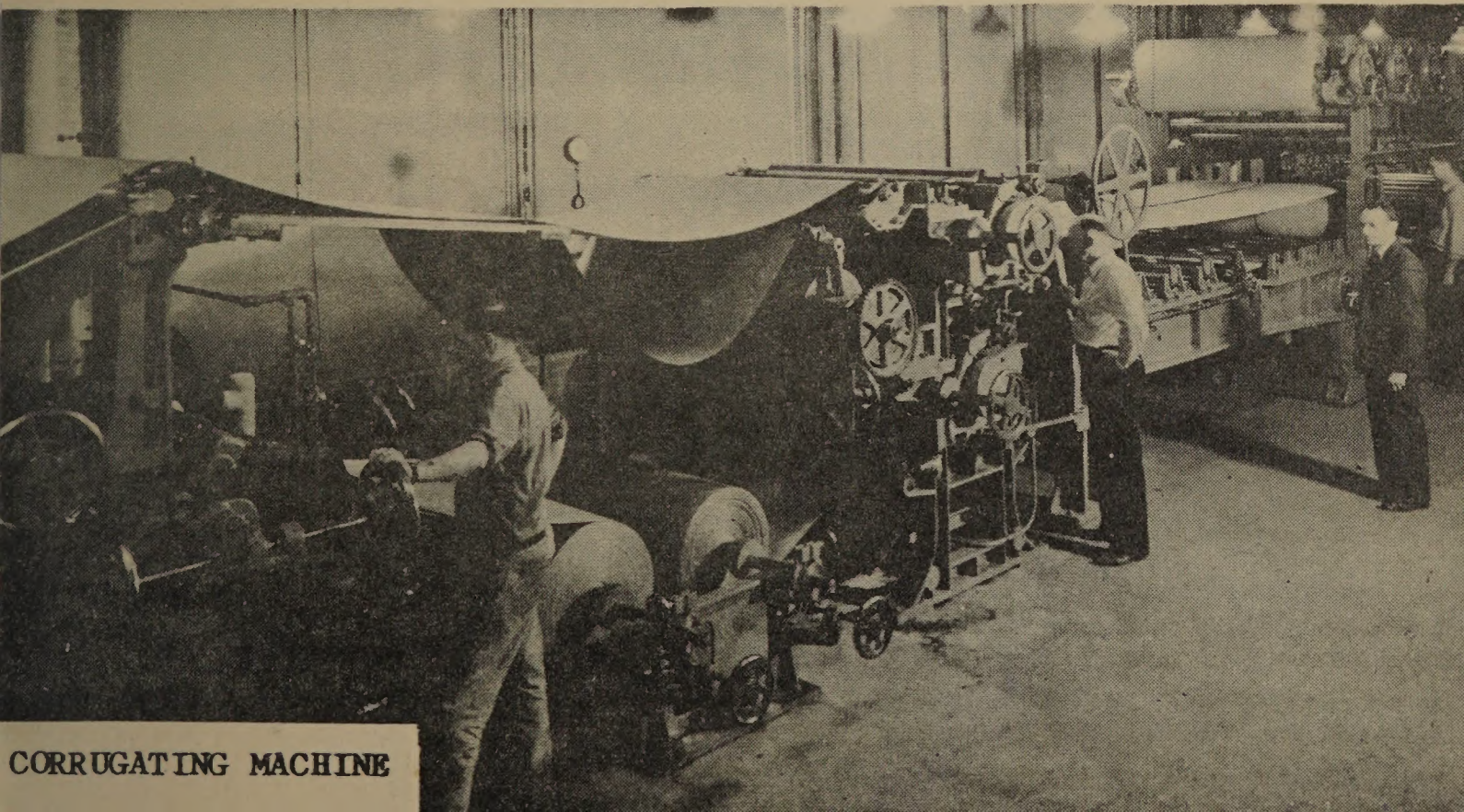
Outstanding work of the Laboratory in this field has included: exploring the possibilities of more than 100 American woods as pulp and paper material; the adaptation of the standard pulping processes to little-used species; the development of new high-yield processes; the study of bleaching of high-yield pulps; the production of white papers from sulfate pulps; and the production of serviceable papers and paperboards from wood wastes.



REFINING PULP IN LABORATORY BEATER

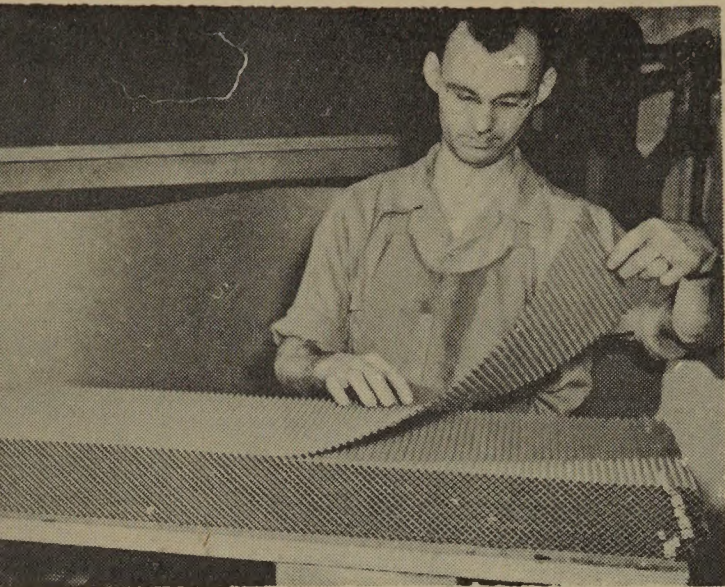


PRODUCING PULP BY
MECHANICAL GRINDING



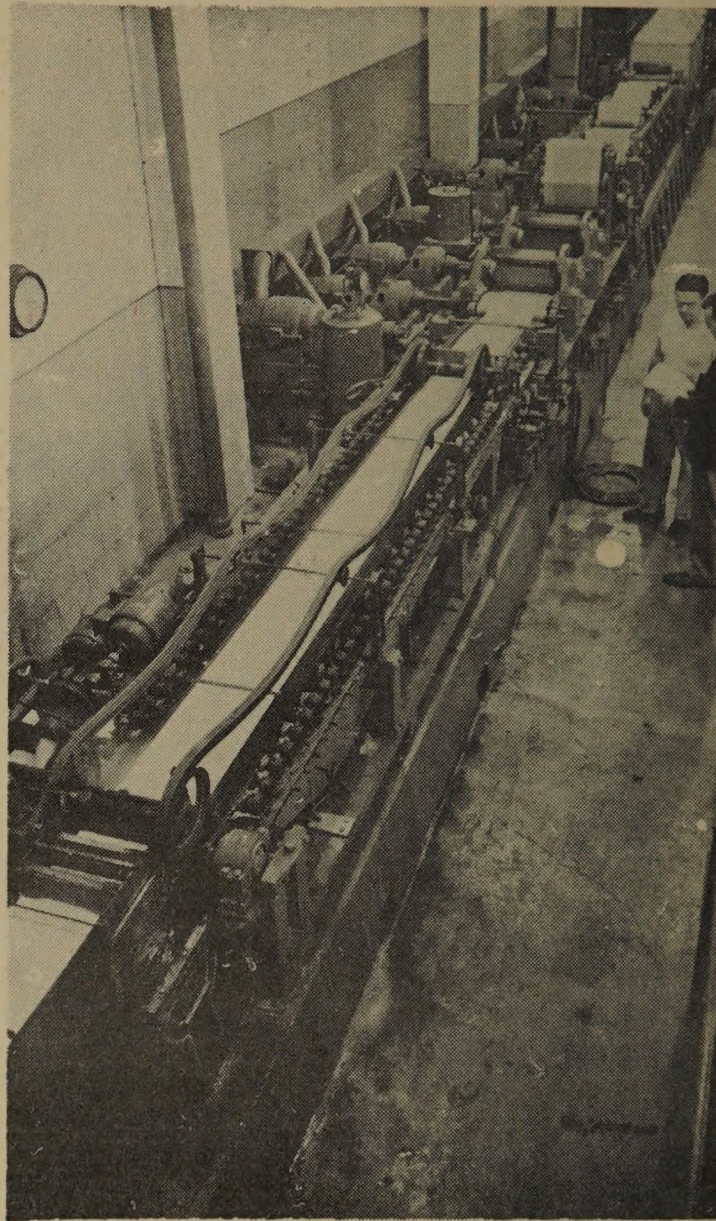
CORRUGATING MACHINE

LABORATORY EQUIPMENT MUST BE VARIED AND PRECISE

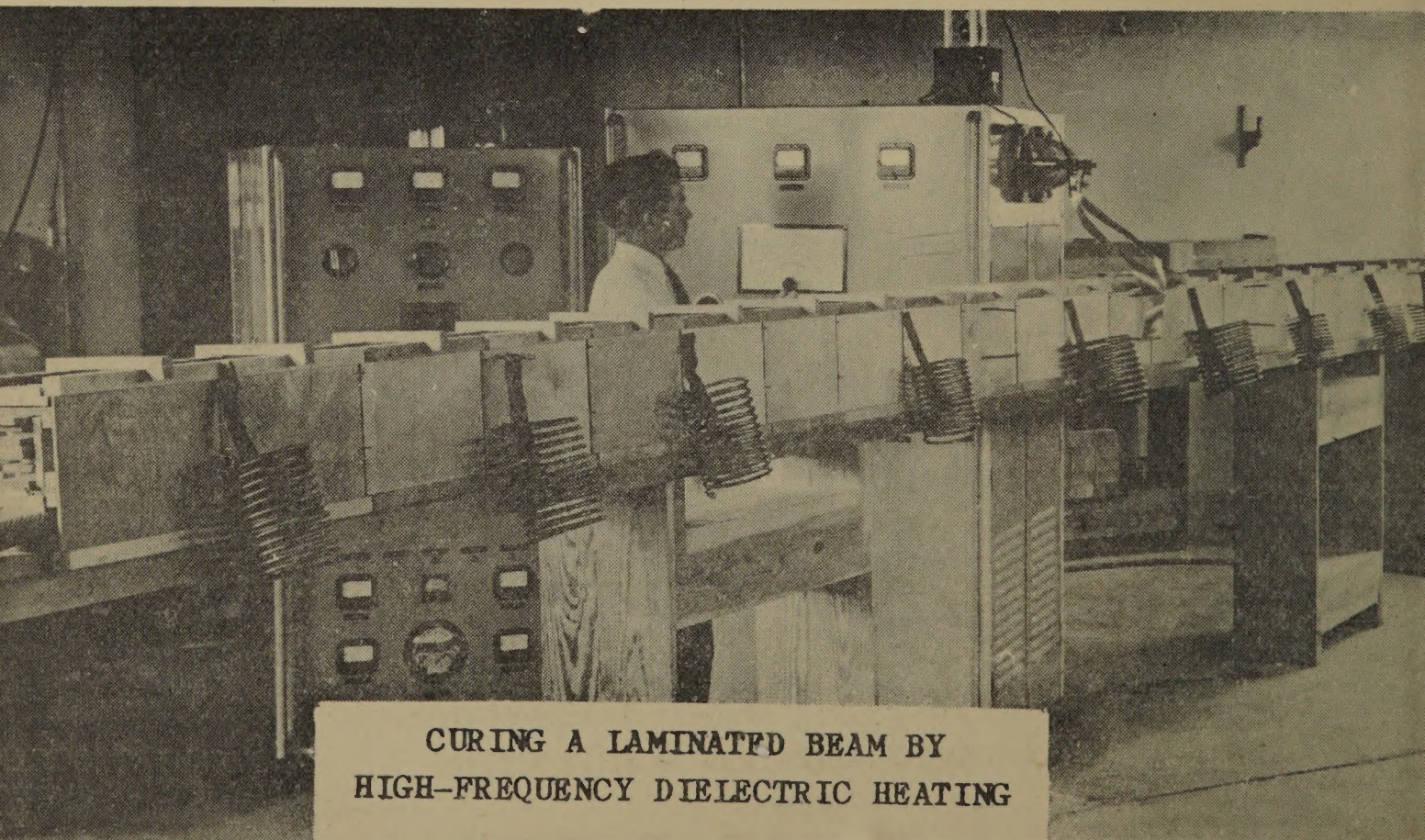


FABRICATING A
"SANDWICH" HOUSE PANEL

There has been gathered at the Laboratory what is probably the most varied and complete collection of equipment for testing forest products in the world. This equipment makes possible a varied attack on the many problems studied at the Laboratory each year.

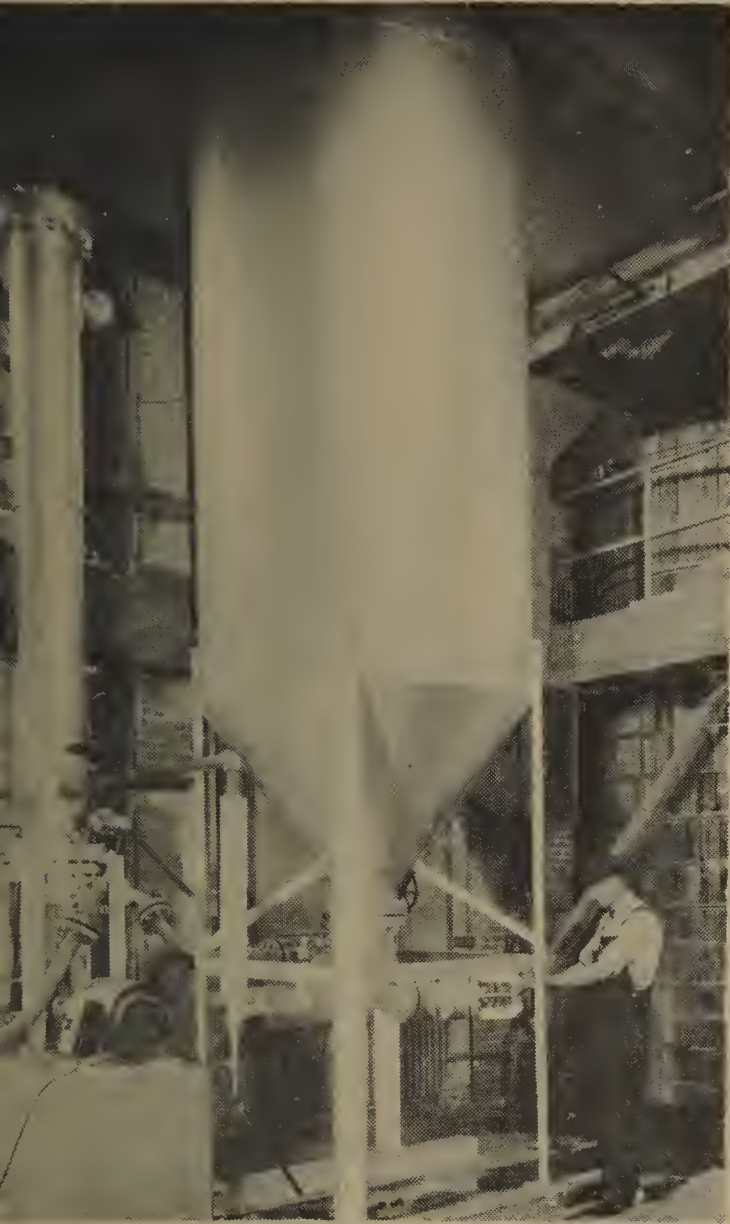


MAKING EXPERIMENTAL PAPER
UNDER PRECISE CONTROL



CURING A LAMINATED BEAM BY
HIGH-FREQUENCY DIELECTRIC HEATING

NEW DEVELOPMENTS ARE TESTED FOR PRACTICALITY



DIGESTER FOR PULPING EXPERIMENTS



PIONEER PREFABRICATED HOUSES ON
LABORATORY GROUNDS

As new technical methods in the utilization of forest products are evolved from the research carried on at the Laboratory, they are extensively tested to determine whether they are practical and can actually be put to use. As the work of the Laboratory is to bring about more profitable use of wood, to attain this end theoretical calculations and experimental results are checked and double-checked before they are released to the public.



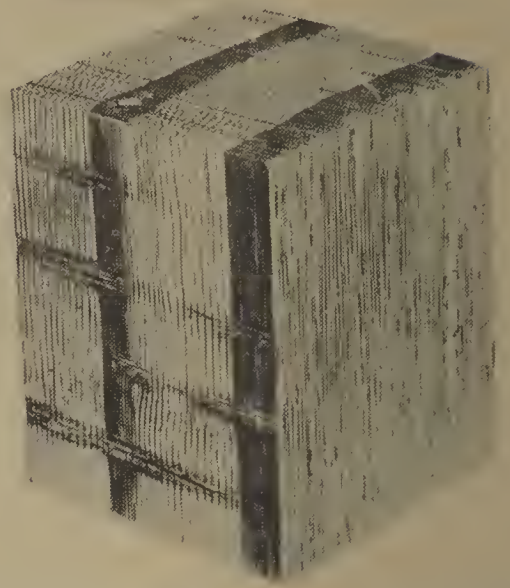
UNUSUAL CONTAINER CONSTRUCTION

STRUCTURE AND COMPOSITION OF WOOD DEPEND UPON GROWTH CONDITIONS

The conditions under which a tree grows have a marked effect upon the strength and other properties of the wood. Laboratory investigations in this field have two objectives: to make the best use of the wood already grown; and to determine how conditions can be controlled to grow trees of high quality for various uses. Knowledge of the effect of growth conditions makes it possible for users to select good wood for specific uses, to diagnose the causes of good or poor service, or to make available another species with the desired properties for a given species that is not obtainable.

Technical service in wood identification is offered by the Laboratory, which examines about 3,000 such samples each year. Frequently, important questions of commercial use and even lawsuits hinge on the result of an examination of a few chips or shavings, sawdust or wood flour.

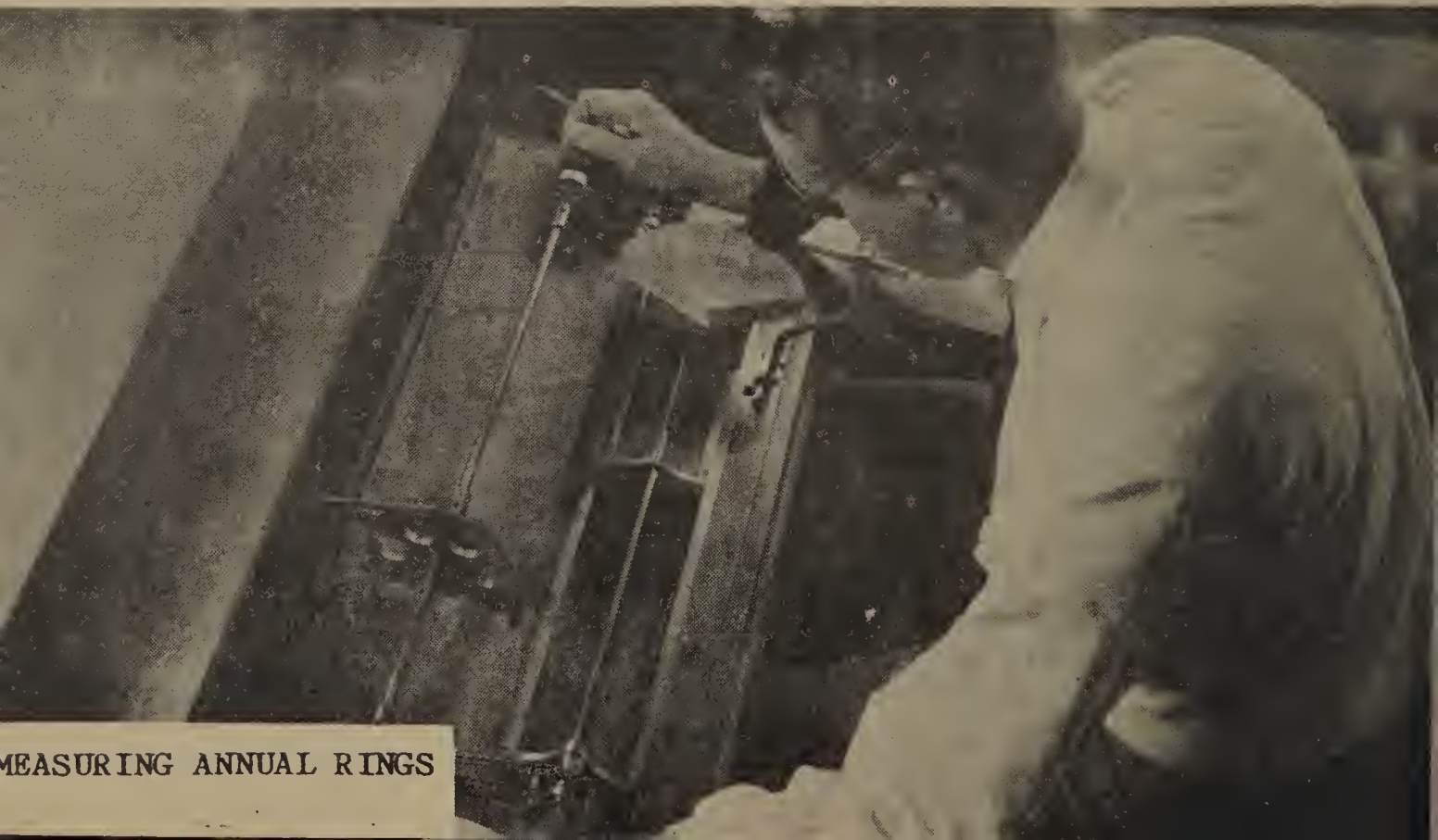
Since World War II the Laboratory has received many inquiries about foreign woods. Although extensive research on foreign woods is not a part of the Laboratory's current program, existing data from all available sources are being compiled for use by those interested.



A MAGNIFIED BLOCK OF A SOFTWOOD



WOOD IDENTIFICATION



MEASURING ANNUAL RINGS

RESEARCH AIDS EFFICIENT PRODUCTION OF FOREST PRODUCTS



GRADING SAWLOGS FOR QUALITY
PAYS DIVIDENDS



IMPROVED SAWING METHODS

Results of laboratory investigations of timber harvesting and manufacturing are carried into the woods, sawmills, and factories of the entire nation. Increased yields and reduction of excessive handling in the recovery of usable byproducts have been the result. Prominent in the over-all forest economy is the large group of small loggers and farmers. Individually, these operators are in no position to conduct research aimed at improving their efficiency. To them, therefore, the Laboratory has given major assistance in the development and application of improved logging and milling mechanisms.

Major progress has been made in establishing a technical basis for hardwood sawlog-grading rules to be used by buyers and sellers of logs. Research on saw and cutter-knife performance at different feed rates, speeds, and cutting angles has assisted operators in tuning up their mills to maximum performance and in reducing saw kerfs and miscuts. Likewise, equipment manufacturers have been furnished basic information for achieving a more perfect saw and sawmill performance to replace the rule-of-thumb methods under which they operated in the past.

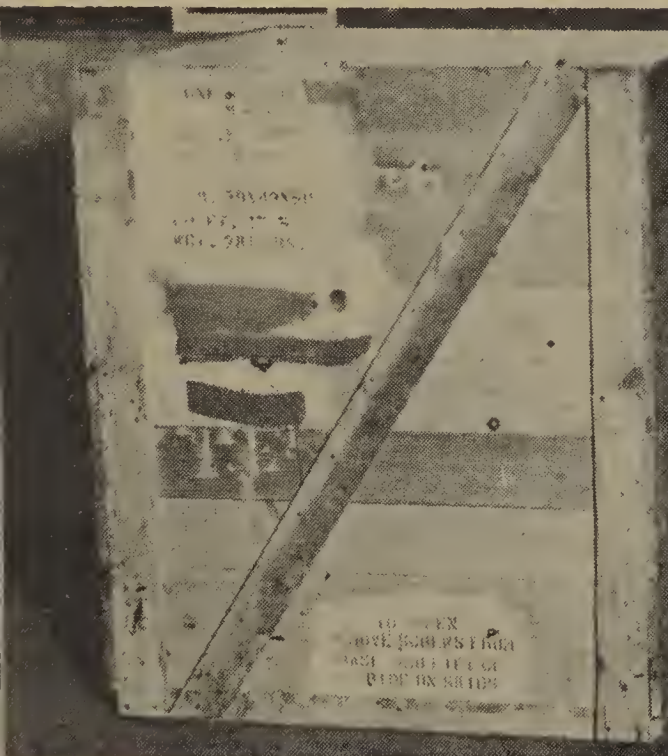
SCIENTIFIC PACKAGING SAVES MATERIALS



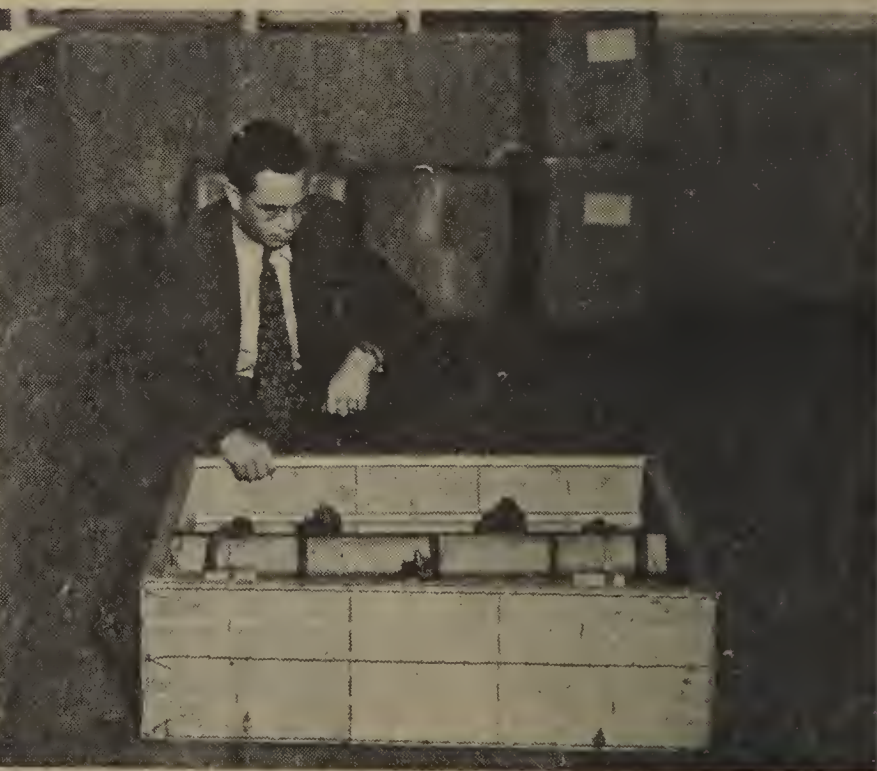
REVOLVING DRUM FOR TESTING BOXES



CRATES ARE DESIGNED FOR MANY PURPOSES



BEFORE



AFTER

CHANGING DESIGN PERMITTED REDUCED SHIPPING SPACE.

The packaging of materials has developed into a science. Effective packaging protects merchandise against deterioration that may result from exposure to both the natural and the man-made hazards involved in handling, storage, and shipment. Laboratory investigations are aimed at accomplishing this end with the minimum use of packaging materials and the minimum damage to the goods packaged. These investigations resulted in the saving of many millions of dollars by the armed forces during World War II and in similar savings to industry in peacetime, both brought about by reduction of damage in transit or storage and decreased shipping weights and costs.

Work on packaging at the Laboratory includes the use of bags, boxes, crates, cartons, and barrels — all, of course, involving the use of wood or wood fiber.

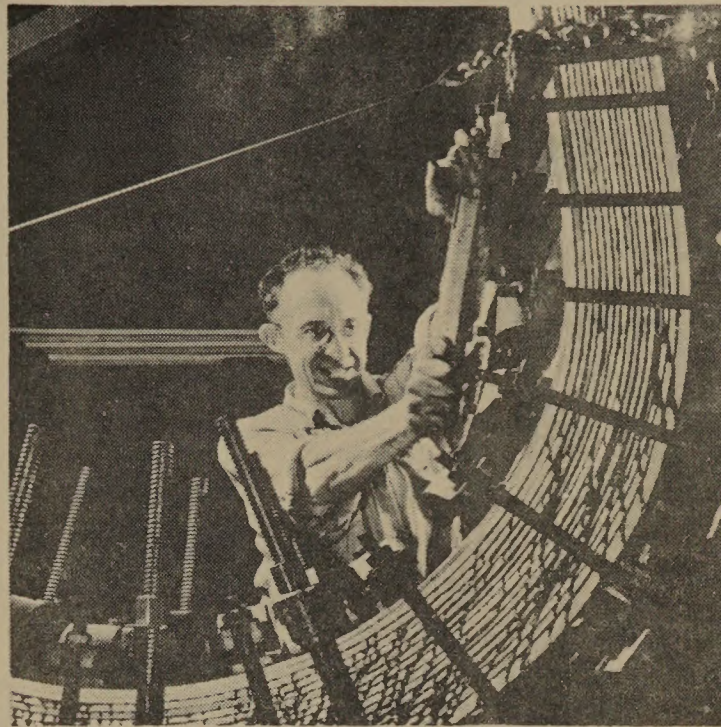
The Laboratory has developed packages to protect goods when dropped from airplanes, submerged in water, exposed to tropical heat, or trucked over unsurfaced trails. Materials packaged vary in size and kind from delicate instruments to army tanks, from eggs to airplanes, and from cheese to superchargers.

WOOD - TREATING PROCESSES ADD TO THE SERVICE VALUE OF WOOD

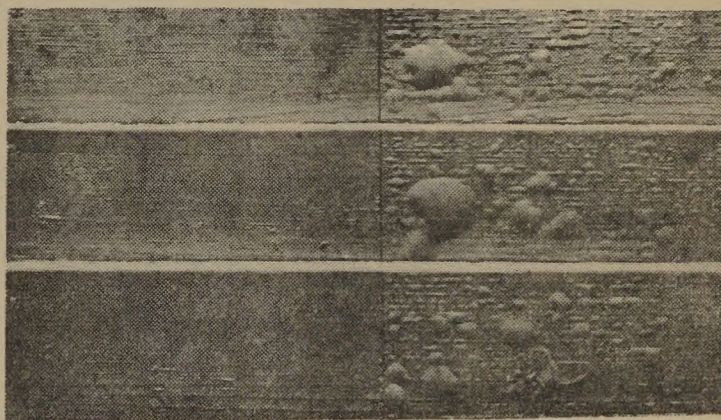
Wood in service can be damaged by decay, insects, marine organisms, moisture, fire, and other deteriorating agencies. Losses from these causes can be drastically reduced by treatments with preservatives, moisture retardants, or fire retardants. The effectiveness and relative costs of these treatments have been determined at the Laboratory, and many simple and inexpensive treating processes have been devised. Also, to protect wood against weathering, the most satisfactory methods of painting wood have been determined, and the relative paint-holding power of the principal wood species has been demonstrated.

Improved glues and gluing techniques have opened new outlets for wood in the form of glued laminated structural members and of plywood capable of withstanding severe service conditions, limited only by the characteristics of the wood itself. In some instances the Laboratory has developed improvements in veneer cutting or has shown the limitations that are necessary for the successful cutting of little-used species.

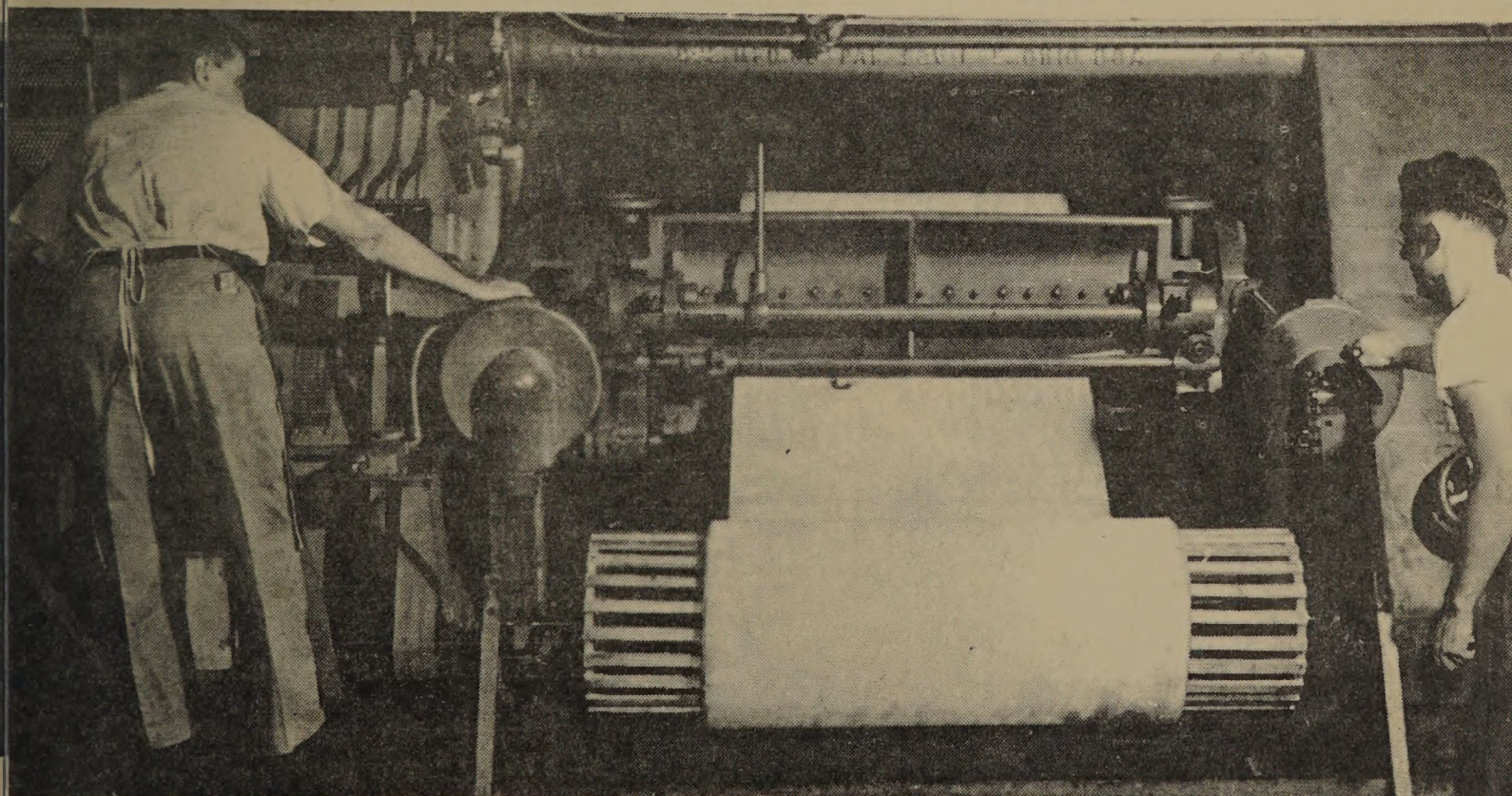
On these and related subjects the Laboratory has served alike the people, industries, and Government agencies as a source of accurate and impartial information.



LAMINATING PERMITS
LARGE BEAMS OF SHARP CURVATURE

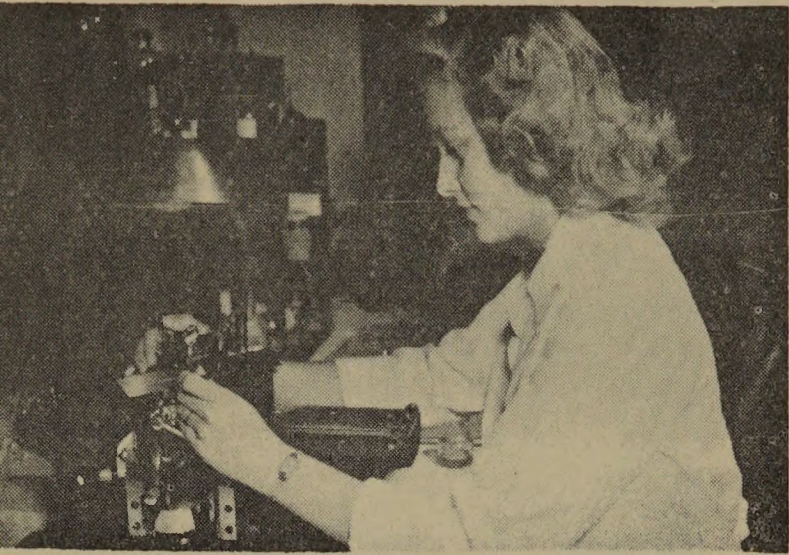


LABORATORY STUDIES SHOW HOW TO
INSURE GOOD PAINTING



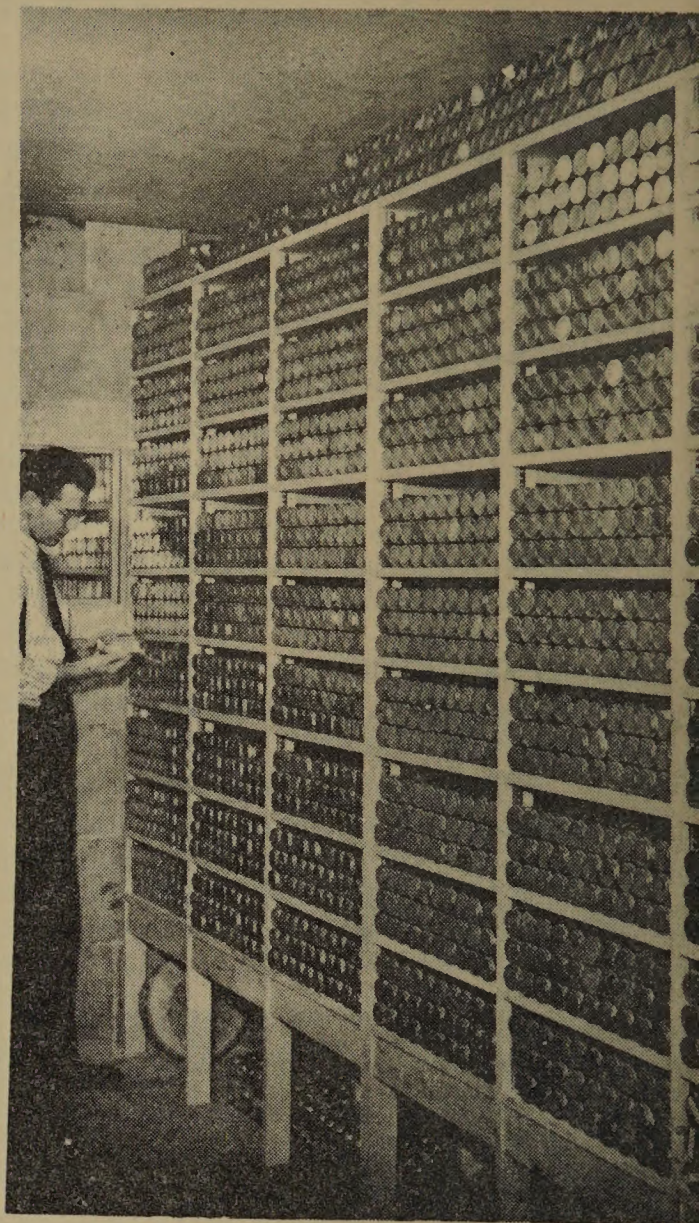
RESEARCH IN CUTTING OF VENEER LEADS TO IMPROVED PLYWOOD

PROTECTION OF WOOD AGAINST DECAY

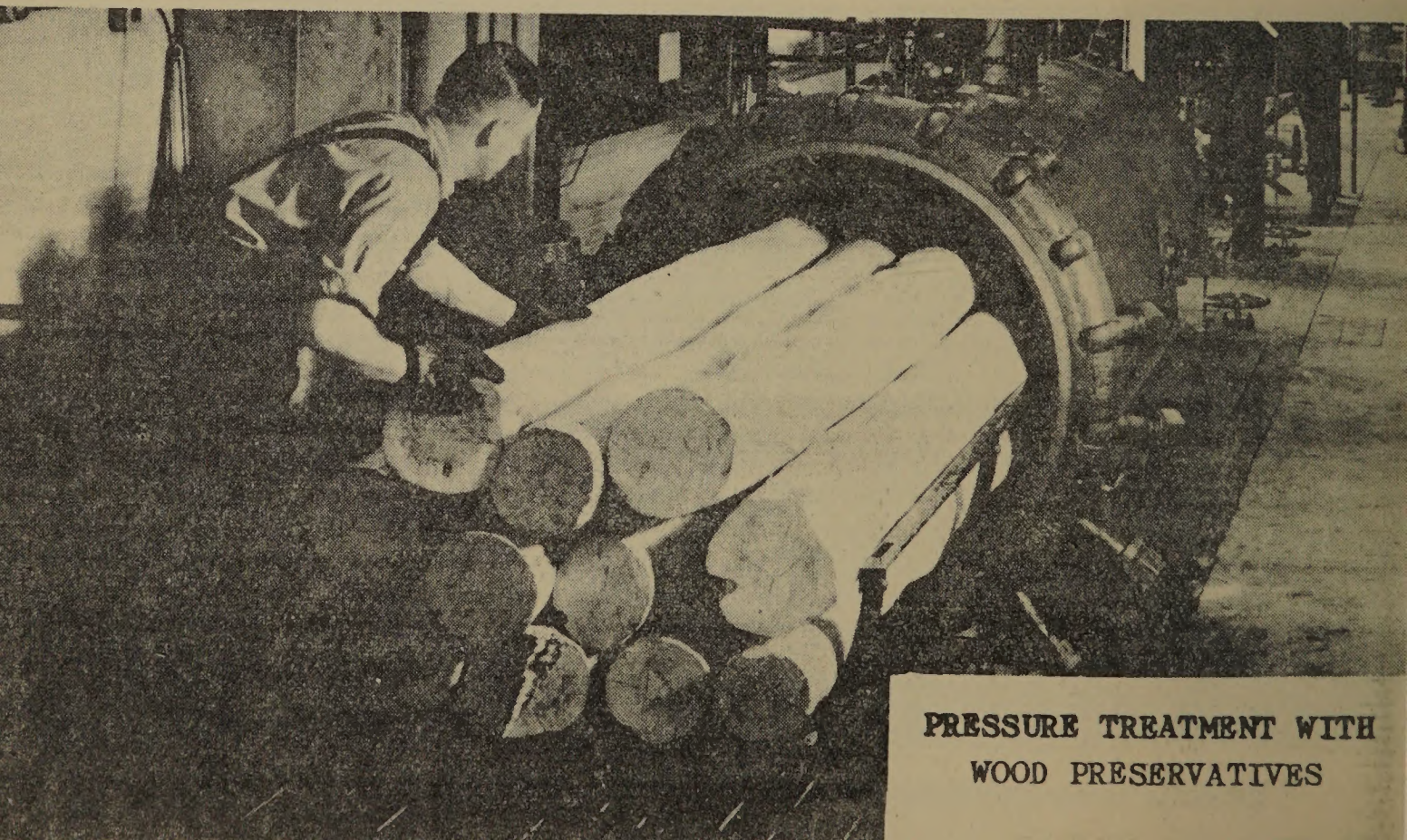


PREPARING WOOD FOR MICROSCOPIC
EXAMINATION FOR FUNGUS INFECTION

When proper usage does not provide adequate protection against decay, the wood should be given a preservative treatment. Unprotected wood in service is being lost through premature decay at a rate equal to the destruction caused annually by forest fires. At the same time, the decay menace is a potent factor in unsatisfactory service and loss of wood markets. Investigations of defects -- decay, staining, and molding -- in wood caused by fungus infection and methods for their control are conducted at the Laboratory by the Division of Pathology of the Bureau of Plant Industry, Soils, and Agricultural Engineering.



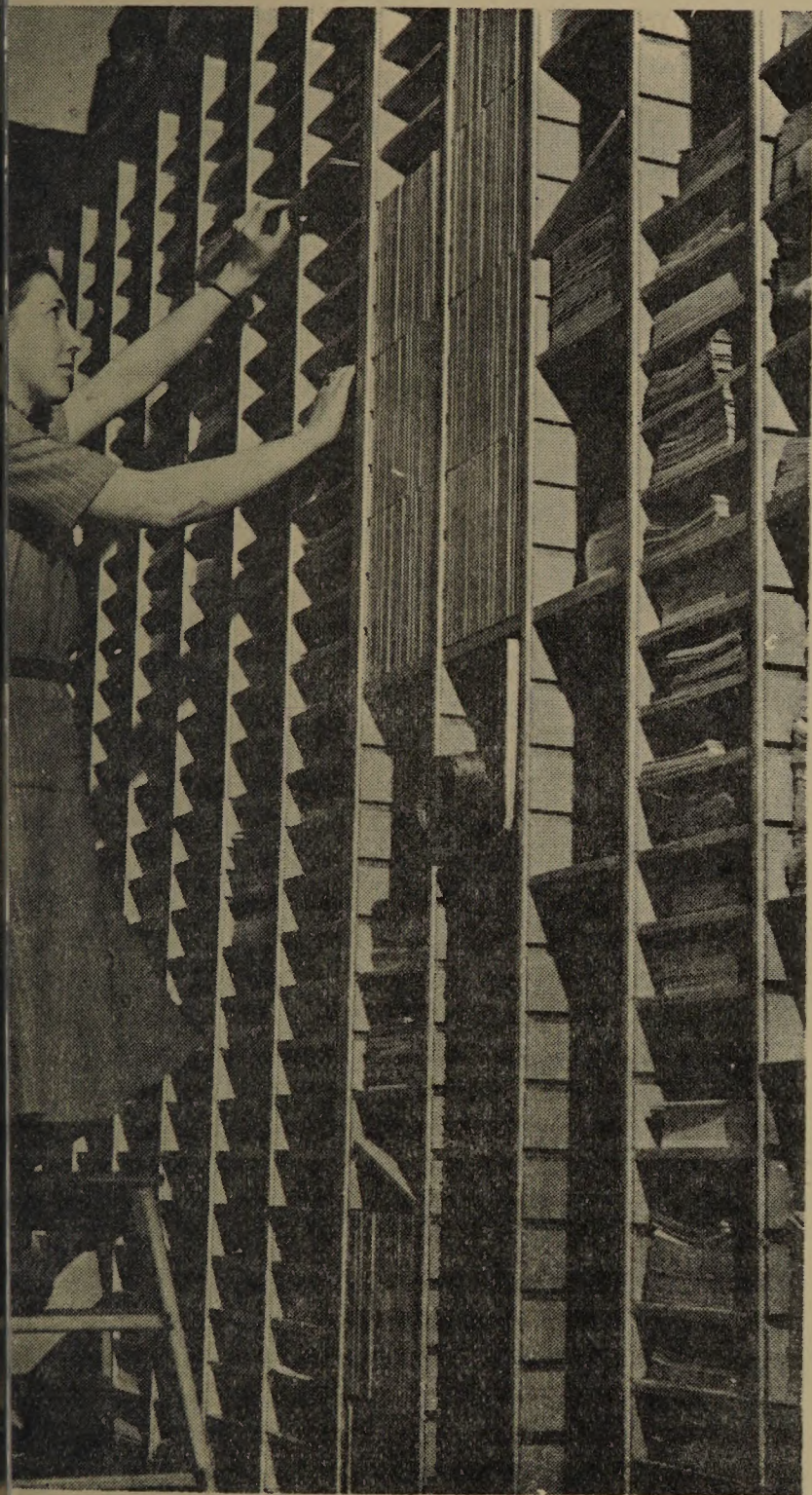
COMPARING EFFECTIVENESS OF
WOOD PRESERVATIVES AGAINST FUNGUS



PRESSURE TREATMENT WITH
WOOD PRESERVATIVES

HOW TO USE THE LABORATORY

All the useful information on wood utilization that the Forest Products Laboratory has gained through research since it was established in 1910 is available to the public. Every year thousands of mail inquiries are answered and wood-utilization problems are discussed with those who come to the Laboratory seeking advice. If you want to know the kind of wood to use for a given purpose, or how to make wood give better service or a better product, Laboratory specialists will advise you. The purpose of this institution is to aid the public in making the most efficient and satisfactory use of forest resources.



Although the Laboratory does not ordinarily conduct research for others, it occasionally accepts difficult and involved problems in wood utilization on a cooperative basis, subject to advance agreement regarding methods and costs. The purpose of such projects is not to promote one product against any other, but to present facts that will enable the public and the industries to put wood to its best use.

Forest Products Laboratory publications are available that cover the main findings of its research work up to the present, and semiannually the Laboratory compiles lists of its new publications from which individuals can select those pertaining to their particular fields of wood use. Visitors are conducted through the Laboratory at regularly scheduled hours.

The Laboratory will be glad to render any assistance possible in your wood-using problems. Inquiries should be addressed to the Director, Forest Products Laboratory, U. S. Forest Service, Madison 5, Wis.

LABORATORY PUBLICATIONS ARE
AVAILABLE TO THE PUBLIC



"FORESTRY IS THE PRESERVATION OF FORESTS BY WISE USE"